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THERMOBAROMETRY IN THE WESTERNMOST INNSBRUCK QUARTZPHYLLITE AND THE PATSCHERKOFEL CRYSTALLINE (EASTERN ALPS, TYROL, AUSTRIA)

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The area of investigation is located in the South of Innsbruck (Tyrol, Austria) and is adjacent to the northern part of the Brenner Basis Tunnel line. The two lithological units studied are the Innsbruck Quartzphyllite and the overlying Patscherkofel Crystalline. Both units show a polymetamorphic evolution, whereas the Patscherkofel Crystalline shows clear evidence for a strong Variscan amphibolite-facies overprint, and geochronological evidence points to a possible Permian event in the Innsbruck Quartzphyllite. Both units show a pervasive Eo-Alpine metamorphic overprint under low- to high greenschist-facies conditions.
The Innsbruck Quartzphyllite contains the mineral assemblage muscovite + albite + quartz ± chlorite ± biotite ± garnet. No pre-Alpine relics have been found so far. Within this unit, a metamorphic zonation with increasing grade from the biotite- into the garnet zone has been observed. The overlying Patscherkofel Crystalline is mainly composed of mica schists with the mineral assemblage albite + plagioclase + muscovite + biotite + chlorite + quartz ± chloritoid ± $garnet_1$ ± $garnet_2$ ± ilmenite ± clinozoisite ± staurolite ± kyanite ± margarite. Pre-Alpine relics are $garnet_1$ + staurolite + kyanite, all other minerals are part of the Eo-Alpine overprint.

Thermobarometry of the Innsbruck Quartzphyllite and the Patscherkofel Crystalline was performed by calculating invariant points with the program TWQ v1.02 [1] and the data base of [2]. These calculations yield pressures ranging from 5.2 to 6.1 kbar and temperatures ranging from 360°C to 476°C for the area in the south of Innsbruck while for the northern Zillertal area pressures ranging from 2.6 to 4.2 kbar and temperatures ranging from 280 to 390°C for the mineral assemblage muscovite + chlorite + quartz [3]. Application of the garnet-biotite thermometer yields temperatures of 500°C to 524°C at pressures in the range of 5–6 kbar for the biotite- and garnet zone within the Innsbruck Quartzphyllite. Chemically hints for higher metamorphic grade of the Innsbruck Quartzphyllite in the south of Innsbruck are manifested through higher Si contents in phengites, which range from 3.10 to3.28 apfu, while Si contents in the northern Zillertal area range from 3.06 to 3.18 apfu [3].

The calculations of samples from the Patscherkofel Crystalline with TWQ v1.02 using the data base of Berman [1] yield an invariant point with pressures of 10.6 ± 0.3 kbar and temperatures of 504.6 ± 7.6°C for the Eo-Alpine mineral assemblage albite + biotite + muscovite + $garnet_2$ + chlorite. Application of the garnet-biotite thermometer and the garnet-plagioclase-muscovite - quartz barometer, yields temperatures of 498°C to 580°C and pressures ranging from 8.2 to 12.2 kbar. These data are in good agreement with the results from the other thermobarometer.

The thermobarometric data and the Si contents in phengite of the Innsbruck Quartzphyllite reveal a decrease in metamorphic grade from the west to the east of the westernmost part of the Innsbruck Quartzphyllite during the Eoalpine metamorphic overprint. The obtained PT-data from the Patscherkofel Crystalline indicate higher metamorphic conditions during an Eoalpine event, which suggest that the Patscherkofel Crystalline was subsequent thrusted onto the Innsbruck Quartzphyllite after the peak of Eoalpine metamorphism.

References

[1] BERMAN, R. G. (1992): written comm.

[2] PARRA, T., VIDAL, O. & AGARD P. (2002): Contrib. Mineral Petrol, 143, 706-732.

[3] PIBER, A. (2002): Unpubl. MSc Thesis, Univ. Innsbruck, 269 p.